Sta #10 (23)

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ENGINEERING DATA TRANSMITTAL

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15. DATA TRANSMITTED

(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	(F) Impact Level	(G) Reason for Transmittal	(H) Originator Disposition	(I) Receiver Disposition
1	WHC-SD-EN-SAD-015		0	300-FF-1 Phase 1 Safety Assessment	2 ESQ	1&2	1	

16. KEY

Impact Level (F)	Reason for Transmittal (G)	Disposition (H) & (I)
1, 2, 3, or 4 (see MRP 5.43)	1. Approval 2. Release 3. Information 4. Review 5. Post-Review 6. Dist. (Receipt Acknow. Required)	1. Approved 2. Approved w/comment 3. Disapproved w/comment 4. Reviewed no/comment 5. Reviewed w/comment 6. Receipt acknowledged

17. SIGNATURE/DISTRIBUTION (See Impact Level for required signatures)

(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN	(J) Name	(K) Signature	(L) Date	(M) MSIN	(G) Reason	(H) Disp.
1		Cog.Eng. L.C. Hulstrom	L.C. Hulstrom	8/28/92	H4-55						
1		Cog. Mgr. R.A. Carlson	R.A. Carlson	8/28/92	H4-55						
1	/	QA ~~D.G. Farwick~~ T.L. Bennington	T.L. Bennington	9-8-92	H4-16						
1	/	Safety F.A. Schmorde	F.A. Schmorde	02 SEPT 92	L6-57						
1		Env. E.M. Greager	E.M. Greager	9/10/92	L6-60						
1		SA&R for W.R. Kerr	W.R. Kerr	7/20/92	H4-75						
1		SA&R J.J. Zimmer	RRK for	7/14/92	N1-83						

OCT 1992 RECEIVED EDMC

18. H.E. Marquez H.E. Marquez 7/20/92 Signature of EDT Originator / Date	19. Authorized Representative for Receiving Organization / Date	20. R.A. Carlson 8/28/92 R.A. Carlson Cognizant/Project Engineer's Manager / Date	21. DOE APPROVAL (if required) Ltr. No. [] Approved [] Approved w/comments [] Disapproved w/comments

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5. Key Words Safety Assessment 300-FF-1 Operable Unit Soil Sampling **APPROVED FOR PUBLIC RELEASE** 9/18/92 N. Dolis		6. Author Name: W.E. Taylor Signature Organization/Charge Code 29550/PC17D	
7. Abstract			

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CONTENTS

1.0 INTRODUCTION

This document provides a safety assessment of hazards for the proposed soil sampling beneath seven specific waste facilities located within the 300-FF-1 Operable Unit at the Hanford Site. Westinghouse Hanford Company (Westinghouse Hanford) is preparing to perform this soil sampling for the U.S. Department of Energy (DOE) with agreement of the U. S. Environmental Protection Agency and the Washington State Department of Ecology (DOE-RL 1990).

1.1 OBJECTIVES

The objectives for the Phase 1 soil sampling activities are 1) to confirm or further define the contaminants present in the soils beneath the seven specific waste facilities identified below; 2) to determine the nature of the contaminants within the fill material in burial grounds No. 4 and 5; 3) to determine the vertical distribution of contaminants within the soil beneath specific waste facilities; 4) to determine physical characteristics of the soils; and 5) to archive samples for potential future analytical purposes.

1.2 WORK DESCRIPTION

Vertical soil borings are planned within or adjacent to the following 300 Area waste sites. Historical information can be obtained from the Waste Information Data System (WIDS) identification numbers shown in parenthesis. The WIDS database is controlled and maintained by Westinghouse Hanford.

- South process pond (316-1)
- North process pond (316-2)
- 307 trenches (316-3)
- 307 retention basins (active)
- Process trenches (316-5)
- Burial ground No. 4 (618-4)
- Burial ground No. 5 (618-5)

All boreholes will be drilled, samples obtained, and field analyses performed in accordance with the procedures and equipment specified in approved Westinghouse Hanford participant contractor, or subcontractor procedures (WHC 1988a). The cable tool drilling method will be used. Each borehole will not exceed 8 in. (20 cm) dia and will extend down to 10 ft (3 m) below the water table. The drilling of each borehole is expected to take approximately 30 d. The boreholes will be abandoned in accordance with regulatory requirements upon completion of the soil sampling survey (DOE-RL 1990; WHC 1988a).

Samples will be obtained from the vertical borings for laboratory contaminant analysis and for physical analysis if required. Samples will be obtained at the surface of every borehole and at least every 5 ft (1.5 m) depth increment to 10 ft (3 m) below the water table. Samples will also be obtained at changes in lithology or at any zones where obvious contamination is encountered.

As previous sampling results (Dennison et al. 1989) indicate a rapid vertical attenuation of contaminant concentrations, the sampling interval will generally be decreased to 1.5 ft (0.46 m) in the upper 6 ft (1.8 m) for the process liquid disposal facility basins with the exception of the 307 trenches which have been backfilled after being deactivated. The samples from these trenches will be obtained at intervals of 1.5 ft (0.46 m) to a depth of 6 ft (1.8 m) below the fill.

The location of the boreholes in burial grounds No. 4 and 5 will be determined upon completion of ground-penetrating radar, soil gas and surface radiation surveys. This data will assist in locating the boreholes to avoid contact with subsurface solid material. The boreholes in or near the other five waste facilities will be located approximately as shown in the sampling and analysis plan provided in DOE-RL (1990). The nearest drilling location to the site boundary, the west bank of the Columbia River, will be at burial ground No. 5, approximately 490 ft (150 m) from the river.

A protective covering of clean fill material will be provided at each boring location in the process liquid disposal facilities to minimize contact between the drilling rig, equipment, crew, and underlying soil. Planking or clean fill material will also be provided along the pond and trench bottoms to allow the drill rig crew to move about with a minimum of contaminant contact and transport.

A more detailed description of the sampling and work activities can be found in the Sampling and Work Plan in DOE-RL (1990).

2.0 HAZARD INVENTORY

Rather than attempt to determine the hazardous material inventory of each borehole site individually, a composite of the highest values for each hazardous material were used from all samples taken at the north and south process ponds (Dennison et al. 1989). This conservative approach to determining the safety of the operations results in very low source terms. These terms are expected to be in the low hazard threshold values provided by Westinghouse Hanford (WHC 1990 Attachment A). Three of the isotopes, uranium-238, uranium-235, and cobalt-60 exceed the exempt quantity amounts, resulting in a low hazard classification. The resulting source term values are so low, no dose exposure criteria for the facility worker or onsite personnel are expected to be exceeded.

A source term is assumed to have been created. The events leading to the generation of the source term are not necessary for this analysis and are not identified. The north and south process ponds maximum inventory was chosen as it is representative of the process and 307 trenches as well as the process ponds (Young et al. 1990; Young and Fruchter 1991). There is one operational safety limit (OSL) provided in Section 3 to assure that the top (approximately) 2 ft (0.61 m) of soil in the area of the process trench where the drilling will occur has been removed prior to borehole drilling activities. An expedited response action (ERA) is in place to remove the top 2 ft (0.61 m) of soil from the bottom surface of the process trenches. Therefore, this assessment does not include the hazardous material in this soil. There is little near-surface hazardous material inventory data for the area south and west of the 307 retention basins. There are no records of spills in this area. Discussions with personnel that were involved with the basins since they became operational disclosed they were not aware of any spills on the south or west sides of the basins. The borehole location will be in this area.

The hazardous materials inventory results from the drilling of a borehole in each of seven various waste sites in the 330-FF-1 operable unit. The inventory is expected to be the maximum brought to the surface in the sand and soil from the top 10 ft (3 m) of each borehole at any of these locations. Based on data from previous sampling (Dennison et al. 1989), hazard inventories 10 ft (3 m) below the surface are expected to be insignificant and therefore not included. The borehole is assumed to be a maximum of 8 in. (20.3 cm) dia.

The combined total inventory of each material from all seven boreholes was considered in this assessment. This inventory results in 2,594 lb (1,176 kg) of contaminated sand and soil from all seven boreholes being combined at one location. This inventory amount is considered implausible as the boreholes are some distance apart, the closest being approximately 200 ft (61 m) while the average separation distance is approximately 1,000 ft (305 m). Further, to accomplish combining the material from all seven boreholes into one location in a form that could result in a source term is complicated by several physical and procedural barriers. While the inventory considered in this paragraph is the combined volumes of the top 10 ft (3 m) from all seven boreholes, the procedures governing the drilling of these boreholes require that 1) all materials brought to the surface be confined from the environment; 2) that full drilling spoils storage drums be promptly removed from the point of generation to the appropriate storage location; and 3) that the material from each borehole be kept in separate metal drums. Accordingly, the inventory basis for this assessment is from one borehole, using a composite of the highest values from samples taken from the north and south process ponds for each hazardous material.

The inventories of record in burial grounds No. 4 and 5 are uranium-bearing trash and uranium-contaminated miscellaneous materials. There is no record of enriched uranium being placed in these burial grounds. In 1979, twenty depleted uranium fuel elements were found near the surface of burial ground No. 4. It is remotely possible that in drilling the boreholes in the two burial grounds, drilling equipment could contact solid uranium metal and bring uranium to the surface in the form of cuttings and solid pieces. Finely divided or freshly exposed dry uranium surfaces oxidize very rapidly, possibly causing some of the chips or small metal fragments to ignite and burn. In this event, the uranium would not represent a hazard of serious concern to the facility worker or the environment as the amount would be such that it would not become a source term greater than the uranium values shown in Tables 2 through 4. The potential radiation exposure to site workers would be minimal. It is possible that there may be other hazardous material in the burial grounds. Geophysical investigations will be made to identify objects buried in the two burial grounds to allow the borehole to be positioned to avoid subsurface solid materials. The first OSL provided in Section 3 requires field testing for flammable and/or explosive vapors as soil samples are brought to the surface.

The inventory of significance considered in this assessment is described in the above paragraph and shown in Tables 1 through 3. The inventory was derived from the data provided by Dennison et al. (1989). The supporting calculations for the data shown in the tables can be found in Attachment A.

While there were several additional organic and inorganic nonradioactive materials detected above background levels, each were in trace amounts or were very small fractions of the threshold limit values, the immediately dangerous to life and health (IDLH) values, the time-weighted average (TWA), or the lower explosive limit. Detailed definitions for the TWA and IDLH are provided in ACGIH (1990) and NIOSH (1990), respectively. Because of their small amount, these materials are not included in the inventory considered in this safety assessment.

Table 1. Radionuclide Inventory and Resulting Concentrations.

Substance	Inventory (μCi)	Soil (pCi/g)	Concentration Facility Worker (μCi/cm^3)	Onsite Personnel (μCi/cm^3)
Cesium-137	0.289	1.72	1.72 E-14	1.20 E-16
Cobalt-60	14.7	87.7	8.77 E-13	6.12 E-15
Uranium-238	213	1,270	1.27 E-11	8.89 E-14
Uranium-235	19.2	114	1.14 E-12	7.98 E-15

Table 2. Facility Worker and Onsite Personnel Radiation Exposure Resulting from the Radionuclide Inventory.

Substance	DAC Limit (in μCi/cc)	DAC Limit Fraction		8-h Estimated Dose Equivalent (rem)	
		Facility Worker	Onsite Personnel	Facility Worker	Onsite Personnel
Cesium-137	7.0 E-8	2.5 E-7	1.71 E-9	5.00 E-9	3.42 E-11
Cobalt-60	1.0 E-8	8.8 E-5	6.14 E-7	1.76 E-6	1.22 E-8
Uranium-238	2.0 E-11	6.4 E-1	4.44 E-3	1.27 E-2	8.89 E-5
Uranium-235	2.0 E-11	5.7 E-2	3.99 E-4	1.14 E-3	7.98 E-6
			Total 8-h exposure =	1.38 E-2 <14 mrem	9.68 E-5 <0.1 mrem

Table 3. Toxicological Inventory Resulting Facility Worker and Onsite Personnel Exposure.

Substance	Inventory (in kg)	Soil Concentration (in ug/g)	Facility Worker	Onsite Personnel	TWA	IDLH
			mg/m^3		mg/m^3	
Calcium	9.26	55,100	0.551	0.004	5	N/E
Chromium $^{+6}$*	0.092	546	0.006	<0.001	0.05	30
Carbon	11.0	65,600	0.656	0.005	1	N/E
Iron	6.87	40,900	0.409	0.003	10	N/E
Magnesium	2.03	12,100	0.121	<0.001	10	N/E
Nickel*	0.308	1,830	0.018	<0.001	0.05	N/E
Uranium	0.015	91.4	<0.001	<0.001	0.2	30

*Carcinogen

NE = none established.

The conservative inventory and resulting concentrations identified in Tables 2 through 4 result in very low exposures to facility workers and onsite personnel located at 330 ft (100 m). Further, as the samples were taken in the spring and early summer of 1987, there will be some reduction of the radionuclide inventory shown in the tables because of decay.

The resultant exposures to the facility worker and onsite personnel are less than regulatory TWA limits. The exposure to an offsite person would be insignificant in all cases and well below regulatory limits.

Naturally occurring energy sources were considered in this assessment. As the resultant exposures to the various receptors assumes worst case, or maximum potential release of the hazardous inventory, events such as flood, lightning, seismic and tornado would not adversely affect the conclusions in this assessment. Range fires also were considered, but they also did not alter the conclusions. Criticality was considered incredible because of the small amount and type of uranium available.

3.0 OPERATIONAL SAFETY LIMITS

There are two OSLs applied to assure the validity of this hazard assessment and to minimize exposure and environmental impact to as low as reasonably achievable. The OSLs apply to 1) field testing the boreholes in burial grounds No. 4 and 5 for explosive and/or flammable vapors, and 2) removing the top (approximately) 2 ft (0.61 m) of contaminated soil from the area in the process trench where the borehole will be located prior to starting drilling.

Operational Safety Limit 1

1.0 **Title** - Field testing of the boreholes for flammable/explosive gases and vapors.

1.1 **Applicability** - This limit applies to the drilling of one borehole in each of burial grounds No. 4 and 5 described in this safety assessment and in greater detail in Phase 1 of the soil sampling program (DOE-RL 1990).

1.2 **Objective** - To alert the driller that the drill bit is in a potentially flammable/explosive atmosphere with a potential for exposing more subsurface hazards.

1.3 **Requirements** - a. Field test the borehole for flammable and explosive vapors prior to reinsertion of the drill string into the borehole.

b. In the event flammable or explosive vapors are detected, shut down drilling equipment and notify the Site Safety Officer.

1.4 **Surveillance** - Project documents will specifically require that the borehole is required to be field tested for flammable and explosive vapors prior to reinsertion of the drill string. Borehole site records will confirm that the borehole has been tested.

1.5 **Recovery** - In the event that the requirements of this OSL are not complied with, all operations at the borehole site where the noncompliance occurred will cease. The violation must be reviewed with Independent Safety and a recovery plan developed. Environmental Engineering will review the recovery plan with Health and Safety Assurance and obtain their approval.

1.6 **Audit Point** - Program work documents and Environmental Engineering site surveillances.

1.7 **Basis** - The hazardous materials inventory identified in this safety assessment is the inventory of record. Because of the nature of burial grounds, (i.e., there is no accurate documentation of contents), actions must be taken to detect and safely deal with hazardous materials that are not considered in this safety assessment.

Operational Safety Limit 2

2.0 **Title** - The top (approximately) 2 ft (0.61 m) of contaminated soil from the process trench must be removed.

2.1 **Applicability** - This limit applies to the drilling of the borehole in either of the process trenches described in this assessment and in greater detail in Phase 1 of the soil sampling program (DOE-RL 1990).

2.2 **Objective** - To assure the validity of this assessment, the hazardous material in the near surface soils in the process trenches must be removed prior to the borehole drilling as this material is not included in the hazardous materials inventory considered.

2.3 **Requirement** - Remove the top 2 ft (0.61 m) of contaminated soil from the borehole site in the process trench prior to starting drilling operations at that location.

2.4 **Surveillance** - Project documents will specifically require the top 2 ft (0.61 m) of soil in the process trench where the drilling will occur be removed before starting drilling operations.

2.5 **Recovery** - In the event that the requirements of this OSL are not complied with, all operations at the borehole site in the trench where the noncompliance occurred will cease. The violation must be reviewed with independent safety and a recovery plan developed. Environmental Engineering will review the recovery plan with Health and Safety Assurance and obtain their approval of the plan.

2.6 **Audit Point** - Program work documents and Environmental Engineering readiness review.

2.7 **Basis** - The hazardous materials inventory identified in this safety assessment is the inventory of record. Because of the nature of the hazardous material in the process trenches and the fact that the material is scheduled to be removed prior to the drilling, the process trench inventory is not included in this assessment.

An ERA (DOE-RL 1991) is planned for the summer of 1991 to remove the top 2 ft (0.61 m) of material in the trenches. In the event this ERA activity is not implemented prior to the drilling described herein, this assessment will be revised prior to drilling to reflect the additional hazardous material inventory.

4.0 REFERENCES

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Young, J.S., Fruland, R.M., and Fruchter, J.S., 1990, *Data Compilation Task Report for the Source Investigation of the 300-FF-1 Operable Unit Phase 1 Remedial Investigation*, PNL-7241, Pacific Northwest Laboratories, Richland, Washington.

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ATTACHMENT A
SUPPORTING CALCULATIONS

INVENTORY BASIS

The volume and mass of contaminated soil brought to the surface at each drilling location is:

$$10\ \text{ft} \times (8/12)^2 \times \pi/4 = 3.49\ \text{ft}^3$$
$$= 6032\ \text{in}^3$$
$$= 98864\ \text{cm}^3$$

The soil density is assumed to be 1.7 g/cm^3
Mass of soil = 1.7 g/cm^3. x 98864 cm^3.=1.68 E05 grams

INVENTORY

Formula: Volume extracted from borehole (in g) X Soil density (in g/cm^3) x specific activity (in $\mu Ci/g$) or concentration (in g/g) = Inventory brought to surface

The following calculations are the inventory at each drilling location assuming the maximum concentrations provided in Dennison et al. 1989.

^{60}Co	:	1.68 E+05 g x 8.77 E-05 $\mu Ci/g$ =	14.7 μCi
^{137}Cs	:	1.68 E+05 g x 1.72 E-06 $\mu Ci/g$ =	0.289 μCi
^{238}U	:	1.68 E+05 g x 1.27 E-03 $\mu Ci/g$ =	213 μCi
^{235}U	:	1.68 E+05 g x 1.14 E-04 $\mu Ci/g$ =	19.2 μCi

Ca	:	1.68 E+05 g x 5.51 E-02 g/g =	9,260 g
Cr	:	1.68 E+05 g x 5.46 E-04 g/g =	91.8 g
Cu	:	1.68 E+05 g x 6.56 E-02 g/g =	11,020 g
Fe	:	1.68 E+05 g x 4.09 E-02 g/g =	6,870 g
Mg	:	1.68 E+05 g x 1.21 E-02 g/g =	2,030 g
Ni	:	1.68 E+05 g x 1.83 E-03 g/g =	307 g
U	:	1.68 E+05 g x 9.14 E-05 g/g =	15.4 g

INGESTION

Ingestion of hazardous materials resulting from the activities during Phase 1 of 300-FF-1 by the drill site workers or those people located at 100 m were considered. As the concentrations were very low and the fact that no crops or produce are grown for ingestion in this operable unit, ingestion values were not calculated as the pathway did not exist.

DRILL SITE AND CONCENTRATIONS AND EFFECTIVE DOSE EQUIVALENTS (EDE)

Formula: Specific activity (in pCi/g) or concentration (in mg/g) x assumed dust loading conditions (in g/m^3) = drill site concentration (in $\mu Ci/m^3$ or mg/m^3).

Air concentrations at the drill site are based on maximum soil contaminant concentrations and moderate dust loading conditions (10 mg/m^3).

^{60}Co : 87.7 pCi/g x μCi/10^{6}pCi x .01 g/m^3 x m^3/10^{6}cm^3 = 8.77 E-13 μCi/cm^3
^{137}Cs : 1.72 pCi/g x 1 E-14 = 1.72 E-14 μCi/cm^3
^{238}U : 1,270 pCi/g x 1 E-14 = 1.27 E-11 μCi/cm^3
^{235}U : 114 pCi/g x 1 E-14 = 1.14 E-12 μCi/cm^3

Ca : 55.1 mg/g x .01 g/m^3 = 0.551 mg/m^3
Cr : .546 mg/g x .01 g/m^3 = 0.006 mg/m^3
C : 65.6 mg/g x .01 g/m^3 = 0.656 mg/m^3
Fe : 40.9 mg/g x .01 g/m^3 = 0.409 mg/m^3
Mg : 12.1 mg/g x .01 g/m^3 = 0.121 mg/m^3
Ni : 1.83 mg/g x .01 g/m^3 = 0.018 mg/m^3
U : .091 mg/g x .01 g/m^3 =<0.001 mg/m^3

Effective Dose Equivalent

Breathing 1 derived air concentration (DAC) for 8 h will give a person an EDE of 0.02 rem.

Derived Air Concentration (μCi/cm^3)*

^{60}Co : 1.0 E-08
^{137}Cs : 7.0 E-08
^{238}U : 2.0 E-11
^{235}U : 2.0 E-11

*WHC 1988

Formula: Air concentration (in μCi cm^3) ÷ DAC (in μCi/cm^3) x 0.02 rem = EDE (in rem)

Resulting EDE for Facility Worker at Drill Site:

^{60}Co : 8.77 E-13 ÷ 1.0 E-08 = 8.80 E-05 x .02 rem = 1.76 E-06
^{137}Cs : 1.72 E-14 ÷ 7.0 E-08 = 2.50 E-07 x .02 rem = 5.00 E-09
^{238}U : 1.27 E-11 ÷ 2.0 E-11 = 6.35 E-01 x .02 rem = 1.27 E-02
^{235}U : 1.14 E-12 ÷ 2.0 E-12 = 5.70 E-02 x .02 rem = 1.14 E-03
Total 8 h exposure = 1.38 E-02 rem
< 14 mrem

100 M (330 ft) CONCENTRATIONS AND EFFECTIVE DOSE EQUIVALENTS

Formula:

Inventory (in μCi or grams) x source reduction factor (0.001) ÷ exposure time, 8 h (in s) x atmosphere dispersion factor - X/Q (1.2 E-02 s/m^3) = air concentration at 100 m [in rem or mg/m^3 (WHC 1990)].

Source Reduction Factor (0.001)

^{60}Co	:	14.7 μCi	x	.001 =	1.47 E-02 μCi
^{137}Cs	:	0.289 μCi	x	.001 =	2.89 E-04 μCi
^{238}U	:	213 μCi	x	.001 =	2.13 E-01 μCi
^{235}U	:	19.2 μCi	x	.001 =	1.92 E-02 μCi

Ca	:	9,260 g	x	.001 =	9,260 mg
Cr	:	91.8 g	x	.001 =	91.8 mg
Cu	:	11,020 g	x	.001 =	11,020 mg
Fe	:	6,870 g	x	.001 =	6,870 mg
Mg	:	2,030 g	x	.001 =	2,030 mg
Ni	:	307 g	x	.001 =	307 mg
U	:	15.4 g	x	.001 =	15.4 mg

Release Rate (8 h)

8 h = 28,800 s

^{60}Co	:	1.47 E-02 μCi	÷	28,800 s =	5.10 E-07 μCi/s
^{137}Cs	:	2.89 E-04 μCi	÷	28,800 s =	1.00 E-08 μCi/s
^{238}U	:	2.13 E-01 μCi	÷	28,800 s =	7.40 E-06 μCi/s
^{235}U	:	1.92 E-02 μCi	÷	28,800 s =	6.65 E-07 μCi/s

Ca	:	9,260 mg	÷	28,800 s =	3.22 E-01 mg/s
Cr	:	91.8 mg	÷	28,800 s =	3.18 E-03 mg/s
Cu	:	11,020 mg	÷	28,800 s =	3.83 E-01 mg/s
Fe	:	6,870 mg	÷	28,800 s =	2.39 E-01 mg/s
Mg	:	2,030 mg	÷	28,800 s =	7.05 E-02 mg/s
Ni	:	307 mg	÷	28,800 s =	1.07 E-02 mg/s
U	:	15.4 mg	÷	28,800 s =	5.35 E-04 mg/s

Air Concentrations at 100 M (330 ft)

Atmospheric dispersion factor = 1.2 E-02 s/m^3 (WHC 1990)

^{60}Co	:	5.10 E-07 μCi/s	x	1.2 E-08 s/cm^3	=	6.12 E-15 μCi/cm^3
^{137}Cs	:	1.00 E-08 μCi/s	x	1.2 E-08 s/cm^3	=	1.20 E-16 μCi/cm^3
^{238}U	:	7.40 E-06 μci/s	x	1.2 E-08 s/cm^3	=	8.89 E-14 μCi/cm^3
^{235}U	:	6.65 E-07 μCi/s	x	1.2 E-08 s/cm^3	=	7.98 E-15 μCi/cm^3

Ca	:	3.22 E-01 mg/s	x	1.2 E-02 s/m^3	=	3.86 E-03 mg/m^3
Cr	:	3.18 E-03 mg/s	x	1.2 E-02 s/m^3	=	3.82 E-05 mg/m^3
Cu	:	3.83 E-01 mg/s	x	1.2 E-02 s/m^3	=	4.60 E-03 mg/m^3
Fe	:	2.39 E-01 mg/s	x	1.2 E-02 s/m^3	=	2.87 E-03 mg/m^3
Mg	:	7.05 E-02 mg/s	x	1.2 E-02 s/m^3	=	8.42 E-04 mg/m^3
Ni	:	1.07 E-02 mg/s	x	1.2 E-02 s/m^3	=	1.28 E-04 mg/m^3
U	:	5.35 E-04 mg/s	x	1.2 E-02 s/m^3	=	6.42 E-06 mg/m^3

Resulting Effective Dose Equivalent

Formula: shown above

^{60}Co	:	6.12 E-15 ÷ 1.0 E-08 =	6.14 E-07	x	.02 rem =	1.22 E-08 rem
^{137}Cs	:	1.20 E-16 ÷ 7.0 E-08 =	1.71 E-09	x	.02 rem =	3.42 E-11 rem
^{238}U	:	8.89 E-14 ÷ 2.0 E-11 =	4.44 E-03	x	.02 rem =	8.89 E-05 rem
^{235}U	:	7.98 E-15 ÷ 2.0 E-11 =	3.99 E-04	x	.02 rem =	7.98 E-06 rem

Total 8 h exposure = 9.69 E-05 rem
<0.1 mrem

REFERENCES

WHC, 1988, *Radiation Protection*, WHC-CM-4-10, Westinghouse Hanford Company, Richland, Washington.

Dennison, D.I., Sherwood, D.R., and Young, J.S., 1989, *Status Report on Remedial Investigations of the 300 Area Process Ponds*, PNL-6442, Pacific Northwest Laboratories, Richland, Washington.

WHC, 1990, *Implementation Guideline for Hazard Documentation*, WHC-SD-GN-ER-301, REV 0, Westinghouse Hanford Company, Richland, Washington.

ATTACHMENT B
300-FF-1 PHASE 1 SAFETY ASSESSMENT, REV. 1

The *300-FF-1 Phase 1 Safety Assessment* provided the hazard assessment hazards for the proposed soil sampling beneath seven specific waste facilities located within the 300-FF-1 Operable Unit at the Hanford Site. Vertical soil borings are planned within, or adjacent to, the seven waste sites. This activity was found to be a low hazard activity. Hazard classification provides the basis for the level of U.S. Department of Energy (DOE) and Westinghouse Hanford Company (Westinghouse Hanford) review and approval of a hazard within a facility or encountered by an activity. Westinghouse Hanford is preparing to perform this soil sampling for the DOE with agreement of the U. S. Environmental Protection Agency and the Washington State Department of Ecology.

The purpose of this revision is to assess the potential additional hazard of increasing the dia of the boreholes from 8 in. (20 cm) to 10.75 in. (27 cm). The objectives of the sampling program have not changed. There are no other changes in the assessment bases.

The increase in drill hole dia resulted in a mass increase in the spoil pile at each drill site of 2.5 ft^3 (71,300 cm^3) to 6.0 ft^3 (170,200 cm^3), or about 72%. This additional inventory proportionally increases the postulated airborne dose of the consequence model at 330 ft (100 m) from <0.1 mrem effective dose equivalent (EDE) to <0.2 mrem EDE. The maximum of the low hazard classification is 5.0 rem. The increases in the nonradiological source terms at 330 ft (100 m) were also well below levels of significance.

The concentrations at the drill sites did not change. The resultant exposure to an offsite person would continue to be insignificant in all cases and be well below regulatory limits.

The increase in the borehole dia does not change the low hazard classification. The two operational safety limits in *300-FF-1 Phase 1 Safety Assessment* (Section 3) remain unchanged and are applicable to this revision.

ATTACHMENT C
300-FF-1 PHASE 1 SAFETY ASSESSMENT, REV. 2

INTRODUCTION

The *300-FF-1 Phase 1 Safety Assessment* (WHC 1992) provided the hazard assessment for the proposed vertical soil boring sampling activities beneath seven specific waste facilities located within the 300-FF-1 Operable Unit at the Hanford Site (DOE-RL 1990). These vertical soil boring sampling activities being conducted now at the seven waste sites are classified as low hazard activities (WHC 1992). Hazard classification provides the basis for the level of U.S. Department of Energy (DOE) and Westinghouse Hanford Company (Westinghouse Hanford) review and approval of a hazard within a facility or encountered by an activity. Soil sampling activities within the 300-FF-1 Operable Unit are being conducted by Westinghouse Hanford for DOE with agreement of the Environmental Protection Agency and the Washington State Department of Ecology.

This revision summarizes the safety assessment for Phase 2 and scope modifications for the 330-FF-1 Operable Unit Phase 1 activities. The hazardous inventory basis for this assessment is taken from the 300 Area north and south process ponds (as it is representative of the process trenches), the 307 trenches, and the process ponds. The inventories of record in burial grounds No. 4 and 5 are uranium-bearing trash and uranium-contaminated miscellaneous materials. There is no record of enriched uranium being placed in these burial grounds (WHC 1992). The radionuclide inventory consists of very small amounts of ^{137}Cs, ^{60}Co, ^{238}U and ^{235}U. Organic and inorganic nonradioactive materials were detected in trace amounts that are very small fractions of health and safety regulatory limits.

WORK MODIFICATIONS

Phase 2 activities will provide additional boreholes at the Phase 1 waste sites. For purposes of this assessment, the hazards described in the *300-FF-1 Phase 1 Safety Assessment* have not changed (WHC 1992). The proposed modification to both phase activities is a change in sampling approach. Instead of drilling a borehole using the cable tool drilling method, a test pit will be excavated with a backhoe at several of the waste sites. Samples will be taken from the backhoe bucket, eliminating the need for personnel to enter the test pit. The contaminant concentrations at the test pits will not result in an unacceptable risk increase in the exposure to facility workers or individuals 330 ft (100 m) from the activity and offsite. The exposure would remain insignificant in all cases and remain well below regulatory limits (WHC 1991, 1992).

The other modification is using test pits for the characterization of burial grounds No. 4 and 5, and for the removal of cover soil from a nearby site suspected to contain a radiologically contaminated vehicle. Preliminary information from soil gas surveys, geophysical surveys and data from nearby groundwater wells were reviewed to ascertain the location of test pits to be placed within the two burial grounds. There is no indication that volatile organic liquids (VOL) are present in the groundwater, although slightly elevated concentrations of volatile organic constituents have been detected at burial ground No. 4. The conclusion therefore, is that there may be VOLs buried at this location. A test pit will be dug at the shallow end of the burial ground to determine what is present, and a second pit will be located at the deep end of the burial ground trench to characterize the burial ground contents.

A similar testing approach will be used at burial ground No. 5. An initial test pit will be placed in the central region of the burial ground, and a second pit will be placed in the shallow end where the presence of nonferrous metallic objects (believed to be aluminum) was detected. Another test pit will be placed near burial ground No. 5 in the area suspected to contain the buried contaminated truck. If the vehicle is located, a cautious approach will be used to determine the potential safety hazards before proceeding further.

The conservative inventory and resulting concentrations determined for the *300-FF-1 Phase 1 Safety Assessment* resulted in very low exposures to facility workers, individuals located 330 ft (100 m) from the activity, and insignificant to people offsite. The 8-hr estimated dose equivalent (EDE) of less than 14 mrem to the facility worker is less than the regulatory limit of 25 rem. The proposed changes assessed in this revision do not change that conclusion or the low hazard classification. The first operational safety limit (OSL) titled "Field testing of the boreholes for flammable and/or explosive gases and vapors," remains in effect and unchanged for those locations where drilling or trenching is to occur (WHC 1992). The meaning of the word "borehole" is interpreted to include trenches and test pits for the purposes of this assessment. The second OSL titled "The top (approximately) 2 ft (0.61) of contaminated soil from the process trench must be removed," is no longer required because the completed expedited response action work in the 316-5 Process Trenches has removed the contaminated soil (WHC 1991). In addition to the OSL identified above concerning flammable and/or explosive gases and vapors, there are two additional OSLs applicable to Phase 2 activities. These OSLs apply to maximum allowable radiation dose rates at the work sites and to containers uncovered during trenching or digging test pits.

OPERATIONAL SAFETY LIMITS

Operational Safety Limit 1

1.0 **Title** - Radiological dose rate limit.

1.1 **Applicability** - This limit applies to soil or material disturbed or raised to ground level during all 300-FF-1 Phase 2 characterization activities.

1.2 **Objective** - To alert the facility worker that unexpected high radiation dose rates have been encountered.

1.3 **Requirements** - a. Stop all work when activity levels are encountered that exceed 70 mrad/hr (beta/gamma, CP open window, uncorrected) or 3,000 dpm per 100 cm^2 (total alpha) at contact.

b. Remove affected personnel to a low dose rate area.

c. Alert the Health Physics supervisor and the Field Team Leader of the unexpected condition as soon as possible.

1.4 **Surveillance** - Project documents will specifically require that 1) work activity stops when radiation levels exceeding 70 mrad/hr (total beta-gamma, CP open window, uncorrected) or 3,000 dpm/100 cm^2 (total alpha) at contact are encountered; 2) that people be removed from that exposure to a low dose rate area; and 3) that the area Health Physics supervisor be alerted as soon as possible.

1.5 **Recovery** - In the event that the dose rates in Section 1.3 of this OSL are encountered, all operations at the site where the high dose occurred will cease. The condition must be reviewed with Independent Safety and a recovery plan developed. Environmental Engineering will review the recovery plan with Independent Safety and obtain their approval of the plan.

1.6 **Audit Point** - Program work documents and Environmental Engineering site surveillances. An audible log shall be maintained at the site documenting surveillance readings.

1.7 **Basis** - The hazardous materials inventory identified in the original assessment is the recorded inventory. Extensive sampling has been accomplished in the 300 Area; however, it is impossible to sample the entire contents of each waste site. Although unlikely, it is possible waste materials could contain higher radiation levels than previously encountered in the sampling programs. The 70 mrad/hr (total beta-gamma) and 3,000 dpm/100 cm^2 (total alpha) values were chosen as these combined activity levels would indicate the presence of a mass of depleted uranium metal. While no depleted uranium metal is expected or reported to have been disposed of in these quantities, it is prudent to recognize that it is possible. The occupational safety procedures implemented through the Hazardous Waste Operations Permit (HWOP), Job Safety Analysis (JSA), and Radiation Work Permit (RWP) minimize the potential consequences to the facility worker. This OSL will assure that radiological consequences are controlled within the bounds of the safety assessment.

<u>Operational Safety Limit 2</u>

2.0 **Title** - Uncovered containers encountered during Phase 2 activities.

2.1 **Applicability** - This limit applies to material disturbed or raised to ground level during all 300-FF-1 Phase 2 characterization activities.

2.2 **Objective** - To alert the facility worker to potential hazardous material in the container.

2.3 **Requirements** - a. Stop work activities when containers are discovered in waste sites.

b. Remove personnel to a safe location.

c. Alert the Site Safety Officer and the Field Team Leader.

2.4 **Surveillance** - Project documents will specifically require that 1) work activity stops when containers are discovered in waste sites; 2) that personnel are to be removed to a safe location; and 3) that the Site Safety Officer and the Field Team Leader are promptly notified.

2.5 **Recovery** - In the event containers are discovered, all work at that site will cease. The condition must be reviewed with Independent Safety and a recovery plan developed. The recovery plan will be reviewed and approved by Independent Safety.

2.6 **Audit Point** - Program work documents and Environmental Engineering site surveillances. An audible log shall be maintained at the site documenting surveillance readings.

2.7 **Basis** - The hazardous materials inventory identified in the original assessment is the recorded inventory. Extensive sampling has been accomplished in the 300 Area; however, it is impossible to sample the entire contents of each waste site. Although unlikely, it is possible containers of hazardous materials could be present. This OSL will assure potential hazard are adequately assessed and that consequences are controlled within the bounds of the safety assessment. The occupational safety procedures implemented through the HWOP, JSA and RWP minimize the potential consequences to the facility worker.

A HWOP, JSA, and RWP will be obtained before work is started. Interactive discussions between safety personnel and project personnel have led the line organization to adopt additional prudent actions for these characterization activities. Fugitive dust control will be maintained as part of routine operations to minimize the potential hazards created during the excavation process.

REFERENCES

DOE-RL, 1990, *Remedial Investigation/Feasibility Study Work Plan for the 300-FF-1 Operable Unit, Hanford Site, Richland, Washington*, DOE-RL 88-31, U.S. Department of Energy, Richland Field Office, Richland, Washington.

WHC, 1991, *Safety Assessments for the 300 Area (316-5) Process Trenches*, WHC-SD-EN-HC-002, Westinghouse Hanford Company, Richland, Washington.

WHC, 1992, *300-FF-1 Phase 1 Safety Assessment*, WHC-SD-EN-SAD-015, Westinghouse Hanford Company, Richland, Washington.

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